

REMARKS

In view of the above amendments and the following remarks, reconsideration of the rejections set forth in the Office Action of May 31, 2007 is respectfully requested.

Claims 1-8 are pending in this application. Claims 1-3 and 5-8 stand rejected. Claims 1-8 are amended herein. No new matter has been added.

The specification and abstract have been carefully reviewed and revised to make grammatical and idiomatic improvements in order to aid the Examiner in further consideration of the application. A substitute specification and abstract including the revisions have been prepared and are submitted herewith. No new matter has been added. Also submitted herewith are marked-up copies of the substitute specification and abstract indicating the changes incorporated therein.

The Applicants greatly appreciate the Examiner's indication that claim 4 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 1-3, 7 and 8 have been rejected under 35 USC § 102(e) as being anticipated by Fukushima et al. (U.S. Patent No. 6,292,489) (hereinafter referred to as "Fukushima"). Claims 5 and 6 have been rejected under 35 USC § 103(a) as being unpatentable over Fukushima in view of Matsubara et al. (U.S. Patent No. 6,693,875)(hereinafter referred to as "Matsubara").

Claims 1, 7 and 8 have been amended so as to further distinguish the present invention, as recited therein, from the reference relied upon in this rejection.

The above rejection is submitted to be inapplicable to the amended claims for the following reasons.

Claim 1 requires a communication system for supporting reservation of network resources, that includes, in part, a plurality of terminals and a link managing unit operable to update the priority of packets transmitted from a terminal when a link condition of the terminal changes. The priority of each of the packets is included in communication information stored in a communication managing table and each of the terminals is configured to couple to at least another of the terminals through the relaying device, such that when one of the terminals is moved, the link condition changes. When the link condition changes, the link managing unit is operable to update the priority of the packets

transmitted from the one terminal, from a previous priority value associated with the one terminal before the link condition changed, to a new priority value.

In contrast, Fukushima discloses a packet transmitted to a network router device 1 is received at a packet receiving section 2 and stored in a vacant buffer area. A packet classifying section 3Rx checks if the packet connection is registered in the connection management table 4Rx and if the connection is registered, it determines a quality class of the packet on the basis of information in a mapping table 9 and stores it in a queue 6Rx classified by quality corresponding to quality class. If the connection is not yet registered in the connection management table 4Rx, the communication quality management section 7 classifies it from information in the permit list 8 whether or not the traffic control for the connection is permitted. A packet 30 is comprised of a header section 31 and a data section 32. The header section 31 is comprised of priority information 33 for indicating a priority required by the terminal of the transmission device. Notably, Fukushima does not describe revising the priority information 33 from a previous priority value to a new priority value when a link condition changes. Instead, Fukushima discloses packet transmission processing using packets containing priority information 33 for indicating a priority required by a terminal of a transmission device.

Based on the above discussion, it is apparent that the device of Fukushima teaches packet transmission processing using packets containing priority information 33 for indicating priority required by a terminal of a transmission device. Moreover, there is no disclosure or suggestion in Fukushima to modify the priority information 33 of each of the packets transmitted from the terminal when a link condition of the terminal changes, by updating the priority information 33 from a previous priority value to a new priority value. In other words, Fukushima does not disclose a communication system for supporting reservation network resources, that includes, in part, a plurality of terminals and a link managing unit operable to update the priority of packets transmitted from a terminal when a link condition of the terminal changes. The priority of each of the packets is included in communication information stored in a communication managing table and each of the terminals is configured to couple to at least another of the terminals through the relaying device, such that when one of the terminals is moved, the link condition changes. When the link condition changes, the link managing unit is operable

to update the priority of the packets transmitted from the one terminal, from a previous priority value associated with the one terminal before the link condition changed, to a new priority value. Thus, Fukushima does not disclose each and every element recited in amended claim 1.

The Examiner cited the Matsubara reference for disclosing that the relaying device is a base station of a wireless LAN. However, it is clear that Matsubara also fails to disclose or suggest the above-disclosed features of the communication system as recited in claim 1. Therefore, Matsubara fails to address the deficiencies of Fukushima. As a result, claim 1, and claims 2-6 depending therefrom, are patentable over the combination of Fukushima and Matsubara.

Regarding claim 7, it is patentable over the references relied upon in the rejections for reasons similar to those set forth above in support of claim 1. That is, claim 7 recites, in part, a terminal comprising a link managing unit operable to update the priority of each packet transmitted from the terminal when a link condition of the terminal changes, wherein each of the terminals is configured to couple to at least another of the terminals through a relaying device such that when one of the terminals is moved, the link condition changes and the link managing unit is operable to update the priority of the packets transmitted from the one terminal, from a previous priority value associated with the one terminal before the link condition changed to a new priority value. These features are not disclosed or suggested by the references.

Regarding claim 8, it is patentable over the references relied upon in the rejections for reasons similar to those set forth above in support of claim 1. That is, claim 8 recites a communication method for supporting reservation of network resources, that includes, in part, updating a priority of packets transmitted from a terminal when a link condition of the terminal changes, and updating a priority value of the terminal from a previous priority value associated with the terminal before the link condition changed to a new priority value. Each of a plurality of terminals is configured to couple to at least another of the terminals through a relaying device, such that when one of the terminals is moved the link condition changes. These features are not disclosed or suggested by the references.

For the above reasons, it is believed clear that claims 1-8 are not anticipated by Fukushima. Further, it is submitted that there is no teaching or suggestion in the prior art of record that would have caused an ordinary artisan to modify Fukushima in such a manner as to result in, or otherwise render obvious, the invention of claims 1, 7 and 8.

Because of the above-mentioned distinctions, it is believed clear that claims 1-8 are patentable over the references relied upon in the rejections. Therefore, it is submitted that claims 1-8 are clearly allowable over the prior art of record.

In view of the foregoing amendments and remarks, all of the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action are respectfully solicited.

Should the Examiner believe there are any remaining issues that must be resolved before this application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

Yuichi KAWAGUCHI et al.

By 

Kevin McDermott
Registration No. 48,113
Attorney for Applicants

KM/ats
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
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SYSTEM AND METHOD FOR COMMUNICATIONS WITH RESERVATION OF NETWORK RESOURCES, AND TERMINAL THEREFORE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a communication system that supports reservation of network resources, and arts related thereto.

[0003] 2. Description of the Related Art

[0004] In communications ~~under~~in network environments such as environment ~~represented by~~ the Internet, data is decomposed to a plurality of packets, which are transmitted via the network.

[0005] In general, the transmission of packets is processed in a "best effort" mode. This means that traffic of AV (Audio/Visual) communications and traffic of other ~~transmission~~transmission, for example ftp/http ~~transmission~~transmission, are treated equally, although what should be processed in real time is not the traffic of other ~~transmissions~~ transmission but the traffic of AV communications.

[0006] Therefore, when the network is crowded with the traffic of other ~~transmission~~transmission, sound/music may break into pieces or quality of moving-picture may be deteriorated.

[0007] In order to communicate multi-media data, such as AV data, without quality deterioration, it is necessary to reserve network resources using reservation on a network path to guarantee communication quality.

[0008] The IETF (Internet Engineering Task Force) has defined resource management protocol, such as RSVP (Resource Reservation Protocol), as a method of reserving network resources ~~of the Internet standards~~.

[0009] In RSVP, network resources required for multi-media communications are allocated on a communication path from one own terminal to a communication partner

thereof, before the multi-media communications begin.

[0010] When RSVP is used, since the network resources required for every stream can become reservable before the communications begin, communication quality can be guaranteed.

[0011] SBM (Subnet Bandwidth Manager) is protocol for admission control and bandwidth management on IEEE802.1LAN, which is based on RSVP. SBM realizes bandwidth reservation in link layers, using bandwidth management functions called DSBM (Designated Subnet Bandwidth Manager).

[0012] Hereinafter, operation using RSVP will now be explained. In RSVP, bandwidth reservation is performed by transmitting ~~and~~ admission control messages among a network-relaying device that supports RSVP, a transmitting terminal and a receiving terminal. The transmitting terminals transmit a PATH message that describes traffic properties of transmitting data to the receiving terminal.

[0013] The PATH message reaches the receiving terminal via a path composed of the network-relaying device. The receiving terminal transmits to the transmitting terminal a RESV message that describes network resources required for receiving. The network devices on the path reserve ~~reserves~~ their own network resources according to the contents of the RESV message, thereby, the bandwidth reservation of the communication between the transmitting terminal and the receiving terminal is realized. Transmitting a RESV message periodically can continue the reservation of the resources.

[0014] On the other hand, DiffServ (Differentiated Services) is defined in the IETF as a bandwidth reservation method based on reservation of network resources. DiffServ belongs to priority control type protocol. When DiffServ is used, in a DS field of an IP header, the priority value of DSCP (DiffServCodePoint) is set corresponding to priority class classified according to significance of data.

[0015] The network-relaying device on the network can identify priority based on this

DSCP value, and can transmit packets with a higher priority prior to packets with other classes of priority, while relating to the network resources reserved by RSVP.

[0016] IEEE802.1p is defined as a method for realizing priority control in a "layer 2" level. IEEE802.1p may be used in a switch having priority control functions.

[0017] Next, an example of bandwidth reservation is explained. A terminal reserves network resources of network devices existing on a communication path using RSVP. The network-relaying device uses a value of DSCP of an IP header, or a value of IEEE802.1p of an IEEE802.1Q VLAN header, in order to identify the reservation.

[0018] For example, a router, which belongs to the network relaying device, is identified as follows: Packets for each of which DSCP value is "5" belong to a flow whose assigned bandwidth is 30Mbps.

[0019] A switch, which also belongs to the network relaying device, is identified as follows: Packets for each of which IEEE802.1p value is "6" belong to a flow that should be processed in real time.

[0020] On the other hand, the transmitting terminal transmits packets after setting a DSCP value to an IP header of each of the packets and setting an IEEE802.1p priority to a MAC header of each of the packets. The network relaying device can perform ~~performs~~ priority control based on DSCP and/or the IEEE802.1p priority. Thus, ~~priority, thereby,~~ a flow that priority should be set is separated from other flow not requiring priority be set ~~that need not be set~~ priority, thereby guaranteeing performing a bandwidth ~~guarantee~~.

[0021] In the conventional techniques (RSVP and/or SBM), the reservation of resources is performed by transmitting packets for reservation when service begins; ~~while~~ and sending reservation messages periodically to maintain the reservation ~~after~~ that.

[0022] However, as described below, with the conventional techniques, when a terminal moves and the communication path is changed, communication quality cannot

be guaranteed.

[0023] (When a source terminal moves)

[0024] ~~FIG.~~Fig. 13 is a block diagram of a conventional communication system. In this communication system, each of base stations 101, 102 and 103 plays a role of the relaying device. The base station 103 and the base station 101, and the base station 103 and the base station 102, respectively, are connected by a cable and/or wireless.

[0025] A terminal 140 connects to the base station 103, and terminals 110, 120, and 130 connect to the base station 102.

[0026] There is a communication path 200. In the communication path 200, the terminal 140 is a source terminal, and the communication path 200 continues, reaches via the base stations 103 and 102, to the terminal 110 that is a destination terminal. The network resources of the communication path 200 are reserved.

[0027] There is a communication path 201. In the communication path 201, the terminal 120 is a source terminal, and the communication path 201 continues, reaches via the base station 102, to the terminal 130 that is a destination terminal. The network resources of the communication path 201 are reserved.

[0028] As shown using an arrow N1 of ~~Fig.~~FIG. 14, since the terminal 120 has moved, a connection between the terminal 120 and the base station 102 is canceled, and the terminal 120 connects with the base station 101. Consequently, a new communication path 202 is formed. In the communication path 202, the terminal 120 is a source terminal, and the communication path 202 continues, reaches-via the base stations 101, 102 and 103, to the terminal 130 that is a destination terminal.

[0029] However, when the communication path 202 has just been formed, the network resources of the communication path 202 have not been reserved yet.

[0030] If the terminal 120 continues to transmit packets after moving, the terminal 120 transmits packets without reservation until the reservation of communication path 202 is established, while the base stations 101, 103, and 102 perform priority control of

packets belonging to a flow that is not reserved.

[0031] Consequently, since the bandwidth of the traffic of communication path 200 to which priority should be set ~~essentially~~ is essentially suppressed, the communication quality of the traffic may deteriorate.

[0032] (When a destination terminal moves)

[0033] ~~Fig.FIG~~ 15 is a block diagram of a conventional communication system. In the state of ~~Fig.FIG~~ 15, the terminal 140 connects to the base station 103, the terminal 110 connects to the base station 101, and the terminals 120 and 130 connect to the base station 102.

[0034] There is a communication path 203. In the communication path 203, the terminal 140 is a source terminal, and the communication path 203 continues, reaches via the base stations 103 and 101, to the terminal 110 that is a destination terminal. The network resources of the communication path 203 are reserved.

[0035] There is a communication path 204. In the communication path 204, the terminal 140 is a source terminal, and the communication path 204 ~~reaches~~ continues, via the base stations 103 and 102, to the terminal 120 that is a destination terminal. The network resources of the communication path 204 are reserved.

[0036] As shown using an arrow N2 of ~~Fig.FIG~~ 16, since the terminal 120 has moved, a connection between the terminal 120 and the base station 102 is canceled and the terminal 120 connects with the base station 101. Consequently, a new communication path 205 is formed.

[0037] Like the above-mentioned case ~~whose title is "When a source terminal moves"~~, if the terminal 140 continues to transmit packets after the terminal 120 moves, the bandwidth of the traffic of communication path 203 to which priority should be set ~~essentially~~ is essentially suppressed, the communication quality of the traffic may deteriorate.

[0038] In recent years, since wireless LANs and mobile environment spread far and

wide, it is obvious that communication paths frequently change according to moving of a terminal and solution thereof is required.

OBJECTS AND SUMMARY OF THE INVENTION

[0039] Therefore, an object of the present invention is to provide a communication system that, even when one terminal moves, reserving network resources, can guarantee communication quality of the other terminals.

[0040] A first aspect of the present invention provides a communication system for supporting reservation of network resources ~~comprising~~including a plurality of terminals; and a relaying device operable to perform priority control of packets based on priority set to each of the packets to relay among the plurality of terminals. Each terminals, wherein each of the plurality of terminals comprises~~includes~~ a communication-managing table operable to store communication information of both a own terminal and a communication partner thereof. The thereof, both the own terminal and the communication partner being are included among in the plurality of terminals. Each of the plurality of terminals also includes a terminals; a packet-transmitting unit operable to set each of the packets priority for each of the packets according to the communication information stored on the communication-managing table; a packet-receiving unit operable to receive the packets; and a link-managing unit. The link-managing unit is operable to update, when link condition of the own terminal changes, the priority of each of the packets transmitted from the whose source terminal is the own terminal, such that the priority of each of the packets is being included in the communication information stored on the communication-managing table, when a link condition of the terminal changestable.

[0041] With this structure, because since the terminal that moves updates the priority of packets relating to the ~~own~~ terminal, moving of the ~~own~~ terminal does not influence communications of the other terminals~~, thereby~~. Thus, quality of communications of

the other terminals is not deteriorated.

[0042] A second aspect of the present invention provides a communication system as substantially similar to that defined in the first aspect of the present invention. Moreover, the invention, the communication system according to the second aspect includes a further comprising, priority-assigning unit operable to manage, and when requested assign, priority of packets of each of the plurality of terminals, wherein each of the plurality of terminals acquires, from the priority-assigning unit, priority that is set to packets whose source terminal is the ~~own~~-terminal.

[0043] A third aspect of the present invention provides a communication system as defined in the second aspect of the present invention. Moreover, according to the third aspect of the invention, invention, wherein, when the link condition of the ~~own~~ terminal changes, the ~~own~~-terminal acquires, from the priority-assigning unit, a new priority that is set to the packets whose source terminal is the ~~own~~-terminal and updates the priority of the packets whose source terminal is the ~~own~~-terminal to the new priority.

[0044] With these structures, even when the source terminal moves, the priority-assigning unit can set the new priority collectively and efficiently.

[0045] A fourth aspect of the present invention provides a communication system as defined in the first aspect of the present invention. Moreover, according to the fourth aspect of the invention, invention, wherein, when the link condition of the own terminal changes, the own terminal notifies a source terminal of the ~~own~~-terminal that the priority set to packets in communications between the source terminal ~~of the own terminal~~ and the ~~own~~-terminal should be changed. When changed, and wherein the source terminal ~~of the own terminal~~ acquires, from the priority-assigning unit, a new priority to be set to the packets in the communications between the source terminal ~~of the own terminal~~ and the ~~own~~-terminal, the source terminal and updates the priority set to the packets in the communications between the source terminal ~~of the own terminal~~

and the ~~own~~ terminal, to the new priority acquired from the priority-assigning unit.

[0046] With this structure, even when the destination terminal moves, the priority-assigning unit can set the new priority collectively and efficiently.

[0047] A fifth aspect of the present invention provides a communication system as defined in the first aspect of the present invention. Moreover, according to the fifth aspect of the invention ~~invention, wherein~~ the relaying device is a base station of a wireless LAN, such that ~~and wherein~~ the link-managing unit of each of the plurality of terminals judges that the link condition changes when connection between the ~~own~~ terminal and the base station changes.

[0048] With this structure, when a terminal moves ~~under~~ in a wireless LAN environment, the quality of communications of the other terminals can be guaranteed.

[0049] A sixth aspect of the present invention provides a communication system as defined in the first aspect of the present invention. Moreover, according to the sixth aspect of the invention, ~~invention, wherein~~ the relaying device is a switch of a cable LAN, such that ~~and wherein~~ the link-managing unit of each of the plurality of terminals judges that the link condition changes when connection between the ~~own~~ terminal and the switch changes.

[0050] With this structure, when a terminal moves ~~under~~ in a cable LAN environment, quality of communications of the other terminals can be guaranteed.

[0051] The above, and other objects, features and advantages of the present invention will become apparent from the following description read in conjunction with the accompanying drawings, in which like reference numerals designate the same elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0052] ~~Fig.~~FIG. 1 is a block diagram of a communication system in ~~an embodiment~~ a first embodiment of the present invention;

[0053] ~~Fig.~~FIG. 2 is a hardware configuration figure of a terminal in the ~~embodiment~~

~~+~~first embodiment of the present invention;

[0054] ~~Fig.FIG.~~ 3 to ~~Fig.FIG.~~ 5 are flow charts of a link-managing unit in the ~~embodiment+~~first embodiment of the present invention;

[0055] ~~Fig.FIG.~~ 6(a) to ~~Fig.FIG.~~ 6(e) are state diagrams of a communication-managing table in the ~~embodiment+~~first embodiment of the present invention;

[0056] ~~Fig.FIG.~~ 7 is an explanatory drawing of change of a communication path in the ~~embodiment+~~first embodiment of the present invention;

[0057] ~~Fig.FIG.~~ 8 to ~~Fig.FIG.~~ 9 are flow charts of a link-managing unit in ~~an~~ ~~embodiment-2~~a second embodiment of the present invention;

[0058] ~~Fig.FIG.~~ 10 is an explanatory drawing of change of a communication path in the ~~second embodiment~~ ~~embodiment-2~~ of the present invention;

[0059] ~~Fig.FIG.~~ 11 to ~~Fig.FIG.~~ 12 are example explanatory drawings of change of a communication path in the ~~embodiment-2~~second embodiment of the present invention;
and

[0060] ~~Fig.FIG.~~ 13 to ~~Fig.FIG.~~ 16 are explanatory drawings of change of a communication path in the related art.

DETAILED DESCRIPTION OF THE ~~PREFERRED EMBODIMENTS~~INVENTION

[0061] Hereinafter, referring to the drawings, embodiments of the present invention will now be explained.

[0062] (Embodiment 1)

[0063] ~~Fig.FIG.~~ 1 is a block diagram of a communication system in ~~an-embodiment-1~~a first embodiment of the present invention. The first embodiment ~~embodiment-1~~ relates to a case where a source terminal moves to change a link condition of the source terminal.

[0064] This communication system comprises base stations 1, 2, and 3 as relaying devices. The base station 3 and the base station 1, and the base station 3 and the base station 2, respectively, are connected by a cable and/or wireless.

[0065] In ~~the first embodiment~~this embodiment, it is assumed that these base stations 1, 2 and 3 are connected with terminals 10, 20, 30, and 40 by wireless to comprise a wireless LAN.

[0066] Of course, the present invention can be also applied to a case where a cable LAN is constituted similarly.

[0067] In the cable LAN, each of these relaying devices may be a "layer 2" switch.

[0068] The terminal 10 connects to the base station 1, the terminals 20 and 30 connect to the base station 2, and the terminal 40 connects to the base station 3, ~~respectively~~.

[0069] The terminals 10, 20, 30, and 40 ~~comprise~~include communication-managing tables 13, 23, 33, and 43, respectively, link-managing units 14, 24, 34, and 44, respectively, packet-transmitting units 11, 21, 31, and 41, respectively, and packet-receiving units 12, 22, 32, and 42, respectively.

[0070] Each of the communication-managing tables 13, 23, 33, and 43 stores communication information between ~~own~~a terminal and a communication partner thereof. Every terminal (~~own terminal~~) has a communication partner thereof. One of the ~~own~~ terminal and the communication partner is a source terminal and the other is a destination terminal.

[0071] Each of the packet-transmitting units 11, 21, 31, and 41 sets one or more classes of priority to each of the packets, based on communication information stored ~~on~~in each of the communication-managing tables 13, 23, 33, and 43. Moreover, the units 11, 21, 31, and 41 transmit 43, and transmits the packets to a destination terminal thereof via one or more base stations.

[0072] Each of the packet-receiving units 12, 22, 32, and 42 receives packets via one or more base stations from a source terminal thereof.

[0073] Each of the link-managing units 14, 24, 34, and 44 searches communications ~~whose own terminal, that is, each of the terminals 10, 20, 30, and 40~~ when they are operating as source terminals, is a source terminal, in each of the

communication-managing tables 13, 23, 33, and 43, respectively. When the communications exist, each of the link-managing units 14, 24, 34, and 44 updates, regarding the communications, the priority of the packets, which is included in the communication information stored in each of the communication-managing tables 13, 23, 33, and 43, respectively.

[0074] A management server 4 can be arranged in arbitrary locations to which the base stations 1, 2 and 3 can communicate. The management server 4 connects to the base station 3. ~~The management server 4~~ and manages a reservation status of network resources in this communication system.

[0075] A priority-assigning unit 5 is provided in the management server 4. The priority-assigning unit 5 manages the priority of the terminals 10, 20, 30, and 40 and assigns the priority upon receiving ~~when the priority-assigning unit 5 receives~~ a request from each of the terminals 10, 20, 30, and 40. Each of the terminals 10, 20, 30, and 40 acquires, from the priority-assigning unit 5, a priority that should be set to packets being transmitted from the ~~own~~ terminal.

[0076] To be more specific, when the priority-assigning unit 5 receives a source address, a destination address, and a reservation bandwidth from each of the terminals 10, 20, 30 and 40, the priority-assigning unit 5 assigns ~~notifies~~ ~~assigned~~ priority including a value of a DSCP priority and an IEEE802.1p priority to the same terminals. The assigned priority relates to communications in a communication path between the source address and the destination address. Each of the communication-managing tables 13, 23, 33, and 43 comprises one or more entries (See ~~Fig.~~ FIG. 6 (a)) for every communication path.

[0077] In the first ~~this~~ embodiment, each entry has a plurality of fields each of which records the following values, that is, a source address, a destination address, a socket number, a DSCP priority, a DSCP provisional priority, an 802.1p priority, an 802.1 provisional priority, and a "reservation-missing" flag.

[0078] In ~~the first~~ this-embodiment, but for specific explanation, ~~the~~ priority set to a packet includes a set of the DSCP priority and the 802.1p priority. It is assumed that, as shown in ~~Fig.FIG.~~ 6 (a), when an entry ~~has just~~ is established, the following operation is performed for one communication path.

[0079] Each of the link-managing units 14, 24, 34, and 44 sets a corresponding value of the communication path to each of a plurality of fields, that is, the address of source, the address of destination, and the socket number. And, each of the link-managing units 14, 24, 34, and 44 sets an initial value of "0" to a plurality of priority fields, that is, the DSCP priority, the DSCP provisional priority, the 802.1p priority, and the 802.1 provisional priority. Further, each of the link-managing units 14, 24, 34, and 44 sets an initial value of "OFF" to the "reservation-missing" flag. Of course, the values assigned ~~notified~~ by the priority-assigning unit 5 may be used as the initial values.

[0080] When the "reservation-missing" flag is "OFF", it means that this communication path is reserved, whereas, when the "reservation-missing" flag is "ON", it means that this communication path is not reserved.

[0081] ~~Fig.FIG.~~ 2 is a hardware configuration figure of the terminal 10 in the first embodiment ~~embodiment 1~~ of the present invention. Here, since the terminals 20, 30, and 40 have the same configurations as the terminal 10, only the terminal 10 is explained below in order to avoid duplication of explanations.

[0082] As shown in ~~Fig.FIG.~~ 2, a CPU 15 executes a system program expressed by a plurality of flow charts (~~Fig.FIG.~~ 3 to ~~Fig.FIG.~~ 5, ~~Fig.FIG.~~ 8, and ~~FIG.Fig.~~ 9), and controls each of the elements in ~~Fig.FIG.~~ 1. This system program is stored in a ROM 18, which is connected to the CPU 15 via a bus 16. When the CPU 15 executes this system program, the link-managing unit 14 of ~~Fig.FIG.~~ 1 is realized.

[0083] A RAM 17 has a storing region that the CPU 15 needs for processing thereof and a storing region for the communication-managing table 13.

[0084] When a network interface 19 outputs and inputs via the network under control

of the CPU 15, the packet-transmitting unit 11 and the packet-receiving unit 12 are realized.

[0085] Next, referring to ~~Fig.~~FIG. 1 and ~~FIGS. 6(a) AND 6(b)~~Fig. 6, procedures of acquiring priority that the terminal 40 should set to packets thereof is explained. Herein, the terminal 40 is a source terminal and the terminal 10 is a destination terminal.

[0086] ~~4.~~ The terminals 10 and 40 establish socket communications and obtain a socket number mutually. As shown in ~~Fig.~~FIG. 6 (a), ~~each of the link-managing units 14 of the terminal 10 and the link-managing unit 44 of the terminal 40~~ store ~~stores~~ the following values ~~in on~~ the communication-managing tables 13 and 43, respectively. These values include the source address, the destination address, the socket number, the DSCP priority, the DSCP low priority, the 802.1p priority, the 802.1p low priority, and the "reservation-missing" flag.

[0087] ~~2.~~ The terminal 10 ~~transmits~~ notifies information to the management server 4. This information relates to the source address (an IP address of the terminal 40), the destination address (an IP address of the terminal 10), and a requested bandwidth.

[0088] ~~3.~~ The management server 4 judges whether the requested bandwidth is available in the communication path between the terminal ~~terminals~~ 10 and the terminal 40.

[0089] ~~4.~~ When available, the management server 4 assigns priority (the DSCP priority and the IEEE802.1p priority) that can be used in the communication path, and ~~transmits~~ notifies the assigned priority to the terminal 10. In this example, the DSCP priority is set to a value of "32" and the IEEE802.1p priority is set to a value of "6."

[0090] ~~5.~~ The terminal 10 receives this priority from the management server 4. As shown in ~~Fig.~~FIG. 6 (b), the link-managing unit 14 of the terminal 10 stores this priority ~~on~~ in the communication-managing table 14.

[0091] ~~6.~~ The terminal 10 ~~transmits~~ notifies the priority to the terminal 40, and the terminal 40 receives packets using the priority.

[0092] 7. The link-managing unit 44 of the terminal 40 stores the acquired priority value in ~~on~~ the communication-managing table 43.

[0093] 8. The terminal 40 sets the priority to packets thereof and starts communications.

[0094] In the above-mentioned processes, the terminal 10 that is the destination terminal, after querying to the management server 4, transmits ~~notifies~~ the priority to the terminal 40. Otherwise, the terminal 40 that is the source terminal, may, after querying to the management server 4, transmit ~~notify~~ the priority to the terminal 10.

[0095] Thereby, ~~both of the terminal 20 and the terminal 30~~ can communicate using packets each of ~~which~~ having the priority assigned by the management server 4.

[0096] Next, an operating example operation in a case is explained. In the example ~~this case~~, the terminal 20 moves, as shown using an arrow N1 of ~~Fig.~~ FIG. 7, so that ~~what~~ the terminal 20 ~~connect to~~ changes connection from the base station 2 to the base station 1. The operation includes: (1) operation at the time of link-down, or disconnecting ~~link-down~~; (2) operation at the time of link-up, or connecting ~~link-up~~; and (3) operation at the time of re-processing of priority.

[0097] (1) Operation at the time of link-down

[0098] First, referring to ~~Fig.~~ FIG. 3 and ~~FIG. 6(c)~~ Fig. 6, operation when the terminal 20 cancels connection with the base station 2 is explained.

[0099] ~~1-1.~~ When the connection between the terminal 20 and the base station 2 is canceled, at step 1 of ~~Fig.~~ FIG. 3, the link-managing unit 24 detects link-down.

[0100] ~~1-2.~~ When link-down is detected, at step 2 of ~~Fig. 6 (c)~~ FIG. 3, the link-managing unit 24 sets the "reservation-missing" flag of the communication-managing table 23 ~~as to~~ "ON" ~~as shown in FIG. 6(c)~~. By the above, the operation at the time of link-down is completed.

[0101] (2) Operation at the time of link-up

[0102] Next, referring to ~~Fig.~~ FIG. 4 and ~~Fig. 6~~ FIG. 6(c), operation when the terminal

20 connects to the base station 1 is explained.

[0103] ~~2-1-~~When the terminal 20 connects to the base station 1, at step 11 of Fig. 4, the link-managing unit 24 detects link-up.

[0104] ~~2-2-~~ When the link-managing unit 24 detects link-up, the link-managing unit 24 performs the following processes with respect to each of communications stored on the communication-managing table 23. At step 12, the link-managing unit 24 searches a communication whose "reservation-missing" flag is "ON".

[0105] At step 13 to step 15, the link-managing unit 24 changes the present priority of all communications whose "reservation-missing" flags are "ON" such that the DSCP provisional priority and the 802.1 provisional priority (See ~~Fig.FIG.~~ 6(c)) are used. These items of provisional priority do not influence other communications.

[0106] Thereby, at the time of link-up, the priority stored on the communication-managing table 23 is changed. After the priority is changed, the packet-transmitting unit 21 continues to transmit packets being set with the new priority.

[0107] (3) Operation at the time of re-processing of priority

[0108] Next, referring to ~~Fig.FIG.~~ 5 and ~~FIG. 6(e)Fig.-6,~~ operation of re-acquiring priority is explained.

[0109] First, at step 21 of ~~Fig.FIG.~~ 5, the link-managing unit 24 searches a communication whose "reservation-missing" flag is "ON" in the communication-managing table 23. At step 22, when the communication whose "reservation-missing" flag is "ON" exists, at step 23, the link-managing unit 24 requests the management server 4 for re-reservation, transmits ~~notifying~~ the source, the destination, and the required bandwidth. ~~At bandwidth, and at~~ step 24, the link-managing unit 24 acquires new priority from the priority-assigning unit 5 of the management server 4. Herein, it is assumed that new priority (the DSCP priority: "16", and the 802.1p priority: "5") is assigned and acquired.

[0110] Then, at step 25, as shown in ~~Fig.~~FIG. 6 (e), the link-managing unit 24 updates the priority value of the communication-managing table 23. At step 26, the link-managing unit 24 changes the priority of the packets of corresponding communication to the newly acquired priority~~-acquired-newly~~. At step 27, the link-managing unit 24 sets the "reservation-missing" flag of this communication as "OFF". And, the link-managing unit 24 repeats processes of step 22 to step 27 with respect to all communications (step 28).

[0111] In the above processes, since communications using priority that does not influence other communications are performed, until new priority is assigned, quality of other communications is not deteriorated.

[0112] (Embodiment 2)

[0113] A second embodiment ~~An embodiment 2~~ relates to a case where a destination terminal moves to change a link condition of the destination terminal. Hereinafter, referring to ~~Figs.~~FIGS. 8, 9, and 10, a difference from the first embodiment ~~embodiment 1~~ is explained.

[0114] In ~~Fig.~~FIG. 10, the terminal 40 is a source terminal, and the terminals 10 and 20 are destination terminals. Before the terminal 20 moves as shown using an arrow N2, communication paths 203 and 204 are formed. Reservation of network resources is established in these communication paths 203 and 204. The terminal 10 connects to the base station 1, the terminal 20 connects to the base station 2, and the terminal 40 connects to the base station 3.

[0115] Operation when the terminal 20 moves as shown using the arrow N2 will now be explained. The priority-assigning unit 5 assigns priority in the same manner as in the first embodiment~~that of the embodiment 1~~. Also, link-down operation ~~until the item whose number is "2-1" is the same in the second embodiment as in the first embodiment~~as the embodiment 1.

[0116] Now, at step 31 of ~~Fig.~~FIG. 8, when the link-managing unit 24 of the terminal

~~20, which is a destination terminal,~~ detects link-up with the base station 1, the link-managing unit 24 processes as follows concerning communications whose destination terminal is the ~~own~~-terminal (the terminal 20), information of the communications being stored on the communication-managing table 23.

[0117] First, at step 32, the link-managing unit 24 searches a communication whose "reservation-missing" flag is "ON" in the communication-managing table 23. When this communication exists (step 33), at step 34, the terminal 20 ~~notifies~~-transmits "reservation-missing" to the terminal 40, which is a source terminal.

[0118] And the link-managing unit 24 repeats the above-mentioned processes concerning all communications for each of which "reservation-missing" flag is "ON" (step 35).

[0119] Thereby, at the time of link-up, the terminal 20 that moves and is the destination terminal, notifies ~~to~~-the source terminal, which communicates with ~~own~~-the terminal (here the terminal 20), that communications between ~~own~~-the terminal and the source terminal thereof have become "reservation-missing", and information of the communications is stored on the communication-managing table 23.

[0120] At step 41 of Fig. 9, when "reservation-missing" is ~~notified~~-transmitted to the terminal 40, which is a source terminal, by the terminal 20, which is a destination terminal, the terminal 40 performs the following processes.

[0121] At step 42, the link-managing unit 44 of the terminal 40 sets the "reservation-missing" flag of communications with the destination terminal (here the terminal 20) as "ON".

[0122] At step 43, the link-managing unit 44 changes the present priority of the communications such that the provisional priority is used. Thereby, the packet-transmitting unit 41, setting the new priority to packets thereof, continues the communications. The provisional priority does not influence other communications.

[0123] At step 44, the terminal 40 re-requests priority to the priority-assigning unit 5,

and the acquired priority from the priority-assigning unit 5 is set up in the terminal 40. Since the re-requesting processes are the same as the ~~first embodiment~~embodiment-1, explanation thereof is omitted.

[0124] In the above processes, when the destination terminal moves, a notification regarding the move is transmitted ~~the moving thereof is notified~~ to the source terminal. Thereby, the source terminal sets the priority that does not influence other communications until a new priority is assigned to the source terminal, such that the quality of other communications is not deteriorated.

[0125] In both the ~~first and second embodiments~~embodiments-1 and 2, connection using a wireless LAN is explained. However, the present invention can be applied to connections ~~connection~~ using a cable LAN, for example, an Ethernet (registered trademark) ~~similarly~~. Herein, in the wireless LAN, "link-down" means that the base station is changed. In the cable LAN, "link-down" means that the cable is removed from a port of the switch. Of course, it is possible and further desirable to combine the first and second embodiments-1 and 2.

[0126] Next, referring to ~~Fig.FIG.~~ 11 and ~~Fig.FIG.~~ 12, a more specific example is explained. This example relates to a technique that applies the present invention to a public wireless LAN.

[0127] In ~~Fig.FIG.~~ 11, an AV data-transmitting terminal (an AV data server) 40 transmits AV data, and AV data-receiving terminals 10, 20, and 30 play AV data received from the AV data server 40. Here, it is assumed that the AV data-receiving terminal 20 moves from the base station 2 to the base station 1, and further that the base station 1 and the base station 2 constitute a public wireless LAN.

[0128] At this time, operation proceeds as follows:

[0129] (Condition 1): The AV data-receiving terminal 20 notifies to AV data server 40 that the AV data-receiving terminal 20 moves.

[0130] (Condition 2): The AV data server 40 continues communications with the AV

data-receiving terminal 20, while lowering the priority of the communications.

[0131] (Condition 3): The AV data server 40 acquires a new priority from the management server 4.

[0132] (Condition 4): The AV data server 40 continues the communications with the AV data-receiving terminal 20 using the new priority acquired from the management server 4.

[0133] Here, fulfilling from the condition 1 to the condition 4, since communication quality of other terminals, that is, the AV data-receiving terminals 10 and 30, is guaranteed, the AV data-receiving terminals 10 and 30 can continue to play AV data maintaining quality thereof.

[0134] In ~~Fig.~~FIG. 12, the AV data-transmitting terminals (AV data servers) 10 and 20 ~~transmit~~ transmits AV data, ~~respectively~~, the AV data-receiving terminal 30 receives AV data from the AV data server 20, and the AV data-receiving terminal 40 receives AV data from the AV data server 10. Here, it is assumed that the AV data server 20 moves from the base station 2 to the base station 1, and further that the base station 1 and the base station 2 constitute a public wireless LAN.

[0135] At this time, operation proceeds as follows:

[0136] (Condition 5): The AV data server 20, because of moving, continues communications with the AV data-receiving terminal 30, while lowering the priority of the communications.

[0137] (Condition 6): The AV data server 20 acquires a new priority from the management server 4.

[0138] (Condition 7): The AV data server 20 continues the communications with the AV data-receiving terminal 30 using the new priority acquired from the management server 4.

[0139] Here, from the condition 5 to the condition 7, since communication quality of other terminals, that is, the AV data server 10 and AV data-receiving terminal 40, is

guaranteed, the AV data-receiving terminal 40 can continue to play AV data maintaining the quality thereof.

[0140] According to the present invention, even when a terminal moves, the terminal updates the priority of the communications relating to the terminal itself. Therefore, when the priority of the terminal is set up lower than the communications of the other terminals, quality of the communications of the other terminals is not deteriorated.

[0141] When a user of the terminal that moves is a high-priced user or an executive, it is desirable to set the priority of communications of the user higher than other communications at any time, whether the terminal of the user moves or not, thereby, the quality of the communications of the user is guaranteed to be fine by always preventing ~~from~~-quality deterioration.

[0142] Having described preferred embodiments of the invention with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention as defined in the appended claims.

ABSTRACT OF THE DISCLOSURE

The communication system supports reservation of network resources. The base stations relay packets among the terminals, and perform priority control based on the priority set to the packets. In ~~the~~ a terminal, the communication-managing table stores communication information of ~~own-the~~ terminal and a partner thereof. The packet-transmitting unit, setting priority to the packets, transmits the packets. When a link condition of ~~own-the~~ terminal ~~change~~changes, the link-managing unit updates, in order to prevent other terminals from quality deterioration ~~of the other terminals~~, the priority of each of the packets whose source terminal is the ~~own~~-terminal.